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A facility for generation and application of fast neutron

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1. Introduction

A facility for generation and application of fast neutron was developed. This facility will be used for the education of undergraduate student with a major in nuclear engineering and for collaborated researches required thermal or fast neutron irradiation.

We introduce the facility for generation and application of fast neutron to researchers interested about the neutron irradiation and application in this paper.

2. Facility for generation and application of fast neutron

The facility for generation and application of fast neutron is allocated at 31-113B at Seoul National University. The facility is divided into two compartments of fast neutron generation and nuclear detection as shown in Fig. 1. The D-D neutron generator [1] developed at Seoul National University is installed in the fast neutron generation section, being enclosed with the polyethylene (PE) and the borated polyethylene (BPE) as shown in Fig. 2. The neutron activated sample is transferred to the nuclear detection section and γ-ray emitted from the sample is measured. Detailed radiation shielding of the facility and security and safety system was reported on previous researches [2,3].

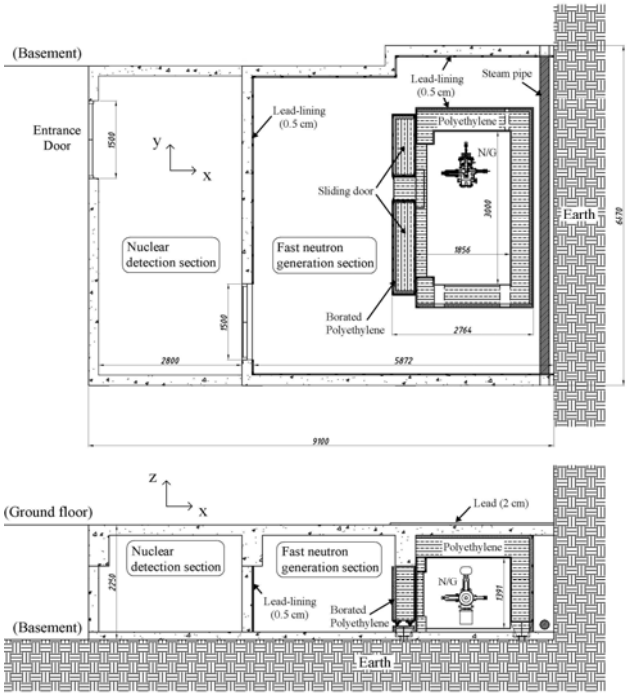
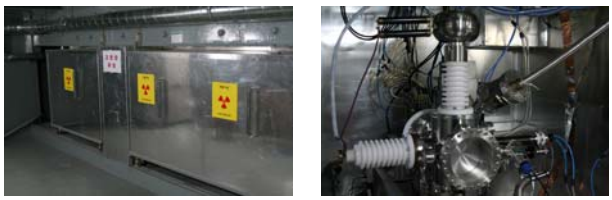


Fig. 1. Layout of the generation and application of fast neutron facility (N/G : neutron generator)



(a) (b)

Fig. 2. (a): neutron shield, (b): installed neutron generator.

3. Device for thermal/fast neutron irradiation and analysis

For fast neutron analysis, it is important to maximize the neutron flux at the sample position and to prevent the damage of the HPGe detector. Fast neutron irradiator is shown in Fig. 3. To reduce the neutron flux into the HPGe detector, PE is used for the material of irradiator. The space of sample mounting is about Φ7 cm × 5 cm and fast neutron flux of which energy is above 1 MeV is 10^5 n/cm^{2}s. For thermal neutron analysis, it is important to reduce the neutron energy while minimizing the neutron loss. Detail design of moderator was reported on previous research [4]. The space of sample mounting is Φ3 cm × 1 cm and thermal neutron flux is about 10^4 n/cm^{2}s [5]. The time of fast or thermal neutron irradiation is about 8 hr.

After the neutron irradiation, the analysis system is selected according to the half-life of the radionuclide. The radionuclide which emits γ-ray simultaneously with the neutron irradiation is analyzed beside the neutron generator, and the radionuclide whose half-life ranges between a few second to a few minute is analyzed after transferring the sample to a low background measurement section. γ-ray spectroscopy system can be operated two modes which are single and Compton suppression mode [6].

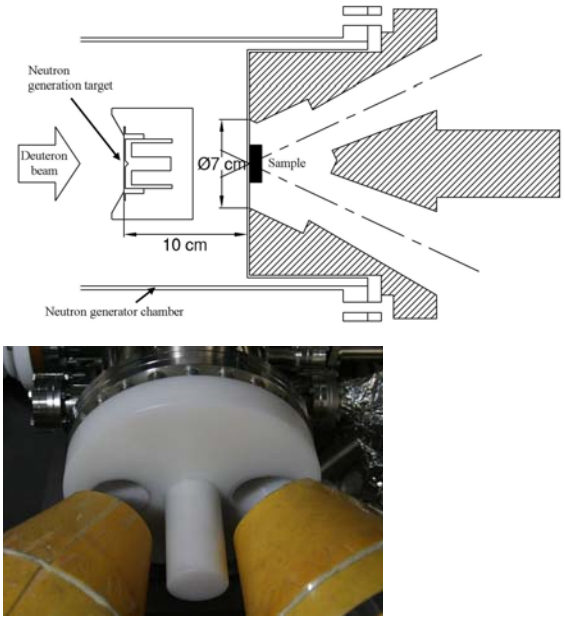


Fig. 3. Fast neutron irradiator and detector collimator

4. Conclusion

A facility for generation and application of fast neutron was developed and will be directly used for education and R&D in college, such as neutron counting, neutron activation analysis, etc. which requires low neutron flux. The neutron generator is small enough to be used as a mobile source. Hence the neutron generator is suitable to use for in-situ researches. To extend the range of the application of neutron generator, collaborated researches using small neutron generator will be required. Detailed information about the facility can be checked at the web page of facility (http://fngf.snu.ac.kr).

Acknowledgement

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